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लेने के लिए विधियाँ

( पहला पुनरीक्षण )

Methods for Sampling of Cotton  
Fabrics for Chemical Tests

( First Revision )

ICS 59.060.01

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## FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards after the draft finalized by the Chemical Methods of Test Sectional Committee had been approved by the Textiles Division Council.

This standard was originally published in 1967. The first revision has been made in the light of experience gained since its publication and to incorporate the following major changes:

- a) Amendment 1 has been incorporated; and
- b) References to Indian Standard has been updated.

The increase in the indigenous production and export of cotton fabrics has made it imperative to evolve sound sampling procedures for objective and economic evaluation of various characteristics of cotton fabrics. Keeping this in view, an Indian Standard on methods for sampling of cotton fabrics for determination of physical characteristics has already been published. This standard recommends the number of tests for determination of various chemical characteristics with specified degree of accuracy, as obtained on the basis of data collected from different textile mills and research organizations throughout the country.

This standard is one of the series of Indian Standards relating to the sampling of textile material. Other standards published so far in the series are:

IS 3919 : 1966 Methods for sampling cotton fabrics for determination of physical characteristics

IS 3920 : 1966 Methods for sampling of cotton yarn for determination of physical characteristics

IS 4952 : 1968 Methods for sampling of cotton-bales, slivers and roving

The composition of the Committee responsible for the formulation of this standard is given in Annex C.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

## *Indian Standard*

# METHODS FOR SAMPLING OF COTTON FABRICS FOR CHEMICAL TESTS

( *First Revision* )

### 1 SCOPE

This standard specifies the methods for sampling of cotton fabrics from bales or cases for chemical tests.

### 2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated.

### 3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

**3.1 Bale (or Case)** — A number of pieces of cotton fabrics packed in a form convenient for transit.

**3.2 Consignment** — The number of bales or cases of fabrics delivered to one buyer against one despatch note.

**3.3 Cotton Fabrics** — A term which covers all types of cloth made from cotton, independent of construction or method of manufacture.

**3.4 Limit of Error of Mean** — The maximum difference between the sample mean and its true value (that would be obtained if all the units in the lot were tested) at a given probability level.

**3.5 Lot** — All bales or cases of fabric of the same type and quality and belonging to the same consignment.

**3.6 Mean** — The sum of the observations divided by the number of observations (*see* Annex B).

**3.7 Mean Range** — The mean of a set of ranges calculated for subgroups in the sample (*see* 3.9 and Annex B).

NOTE — In case the number of test results are ten or more, they shall be divided into subgroups of five test results each by taking them consecutively in the same order as obtained. The range of each subgroup shall then be determined with a view to obtaining the mean range.

**3.8 Piece** — A customarily accepted continuous unit length.

**3.9 Range** — The difference between the largest and the smallest observations in the sample (*see* Annex B).

**3.10 Sample** — Collection of pieces of fabrics selected from a lot for testing.

**3.11 Test Specimen** — A suitable portion of the fabric selected from the sample piece for performing a single test.

### 4 NUMBER OF TESTS

**4.1** The minimum number of tests to be made for determination of various characteristics of fabrics in a lot shall depend upon the accuracy with which the characteristics are to be determined. Table 1 gives the number of tests for the fabrics manufactured in the country for determination of ash content, copper content, chromium content, proofing content, scouring loss, shrinkage, water soluble matter, water absorption (for water-resistant fabrics), wettability and viscosity for varying limits of error. The probability level for the number of tests given in Table 1 varies between 94 and 99 percent.

**4.1.1** The number of tests for the characteristics, namely, acidity, alkalinity, barium activity number, colour fastness to various agencies, pH value of aqueous extract and presence of starch shall be three if the lot consists of 15 or less bales and five otherwise.

**4.2** Unless otherwise agreed to between the buyer and the seller, the number of tests corresponding to 15 percent limit of error of mean for ash content, copper content, chromium content, proofing content, scouring loss, water soluble matter content and viscosity; and 10 percent for shrinkage, water absorption (for water-resistant fabrics) and wettability shall be taken for all routine testing.

### 5 SAMPLING

**5.1** The pieces shall be sampled from each lot for determination of chemical characteristics. In order that the pieces selected are representative of the lot, they shall be distributed over the bales in the lot. Unless

**Table 1 Number of Tests**  
( Clauses 4.1 and 4.3.1 )

Sl No.	Characteristics	Limit of Error for Mean Percent				
		5	6	8	10	15
i)	Ash content	—	30	20	15	5
ii)	Copper content	25	20	10	7	5
iii)	Chromium content	25	15	10	7	5
iv)	Proofing content	25	20	10	7	5
v)	Scouring loss	—	30	20	15	7
vi)	Shrinkage	—	25	15	10	5
vii)	Water soluble matter content	30	20	15	10	5
viii)	Water absorption for (water resistant fabrics)	20	15	10	5	—
ix)	Wettability	—	—	25	15	7
x)	Viscosity	—	30	15	10	5

NOTE — Where the number of tests have become too large or too small they have not been specified.

otherwise agreed to between the buyer and the seller, the number of bales to be taken from a lot for this purpose shall depend on the size of the lot and be in accordance with Table 2.

**Table 2 Number of Bales to be Chosen from a Lot**  
( Clauses 5.1, 5.3.1 and 7.1 )

Sl No.	Lot Size (Bales or Cases)	No. of Bales to be Selected
(1)	(2)	(3)
i)	2 to 8	2
ii)	9 to 15	3
iii)	16 to 25	5
iv)	26 and above	8

**5.2** The bales shall be selected at random from a lot and in order to ensure randomness of selection of the bales IS 4905 shall be used.

**5.3** From each selected bale approximately equal number of pieces shall be chosen at random.

**5.3.1** The minimum number of pieces to be selected from any bale shall be determined by dividing the number of tests to be conducted (*see* Table 1) by the number of bales selected (*see* Table 2). If it comes out to be a fraction, its maximum integral part (*say*, 1) shall be taken and 1 or (1 + 1) pieces shall be chosen from each selected bale so as to get the requisite number of pieces for test. In case the minimum number of tests happens to be less than the number of bales selected, one or more pieces shall be taken from each bale so as to get the number of pieces in multiple of five for test purposes.

**5.4** From each of the pieces selected, one test specimen shall be taken for determining the various characteristics.

**5.5** In case the lot is not in the form of bales or cases, but offered as pieces as such, the number of pieces to be selected at random from a lot for testing for a particular characteristic shall be equal to the number of tests required to be carried out according to 4.

**5.5.1** To ensure the randomness of selection of pieces, the procedure as given in IS 4905 shall be followed. The procedure for sampling shall be simple random sampling or systematic sampling as given in 4.1 or 4.3 respectively of IS 4905.

## 6 CRITERIA FOR CONFORMITY

**6.1** For ascertaining the conformity of the lot to the specification requirements, the following procedure shall be adopted.

**6.1.1** For any of the characteristics mentioned in 5.1.1, all the test specimens subjected to the relevant test shall satisfy the requirements for that test.

**6.1.2 For Other Tests** — From the test results obtained on the test specimens selected according to 5, the mean ( $\bar{x}$ ) and the range ( $R$ ) if the number of tests are less than 10, or the mean range ( $R$ ) if the number of tests are 10 or more, shall be calculated and the procedure given under 6.1.2.1 or 6.1.2.2 shall be followed to ascertain the conformity of the lot to the specified requirements.

**6.1.2.1 For one-sided specification limit** — The lot shall be declared as conforming to the specification if:

- a) the value of the expression  $(\bar{x} + kR)$  or  $(\bar{x} + k\bar{R})$  is less than or equal to  $U$ , when the upper specification limit  $U$  is given; and

OR

- b) the value of the expression  $(\bar{x} - kR)$  or  $(\bar{x} - k\bar{R})$  is greater than or equal to  $L$ , when the lower specification limit  $L$  is given.

where the values of factor  $k$  are given in Table 3 for various sample sizes.

**6.1.2.2 For two-sided specification limit** — The lot shall be declared as conforming to the specification if:

- a) the value of the expression  $\frac{R}{U-L}$  or  $\frac{\bar{R}}{U-L} \leq B$ ,
- b) the value of the expression  $(\bar{x} + kR)$  or  $(\bar{x} + k\bar{R}) \leq U$ , and
- c) the value of the expression  $(\bar{x} - kR)$  or  $(\bar{x} - k\bar{R})$ .

where the values of the factors  $B$  and  $k$  are given in Table 3 for different sample sizes, and  $U$  and  $L$  refer to the specification limits for the individual characteristics.

**Table 3 Values of the Factors**

( Clauses 6.1.2.1 and 6.1.2.2 )

SAMPLE SIZE		
$n$	$k$	$b$
5 and 7	0.3	1.0
10	0.4	0.9
15 and above	0.5	0.8

## 7 ILLUSTRATIVE EXAMPLE

**7.1** A seller delivers to a buyer a consignment consisting of 40 bales, of which 22 bales consist of long cloth and remaining 18 bales consist of poplin. The buyer desires to ascertain the conformity of the fabric supplied to the specification requirements of maximum 2.5 percent and 1.0 percent respectively with regard to shrinkage.

For the purpose of sampling and testing, the consignment shall be divided into two lots (*see 3.5*), one consisting of 22 bales of long cloth and other 18 bales of poplin. The procedure for selecting the sample and determining the conformity is explained below with reference to the first lot only; a similar procedure shall be followed in case of second lot also.

The number of bales to be chosen from a lot consisting of 22 bales shall be five according to Table 2. In order to select five bales at random from the lot, IS 4905 shall be referred. Suppose, in this case, the numbers drawn are 3, 7, 13, 16, 20. Then, starting from any bale, the bales in the lot shall be counted in one order and the bales corresponding to above numbers shall be withdrawn from the lot for selecting pieces from them.

According to 4.2 and Table 1, ten tests corresponding to ten percent error shall be required for determination of shrinkage of the fabrics in the lot. Since the number of bales selected is five, two pieces of fabric shall be chosen from each bale for carrying out the tests.

Let the test results for warpway shrinkage (expressed as percentage) be as follows:

1.8, 2.3, 1.8, 1.7, 1.5, 1.8, 1.3, 1.8, 2.0, 2.0

The mean ( $\bar{x}$ ) of the test results is obtained as:

$$\bar{x} = \frac{1.8 + 2.3 + \dots + 2.0}{10} = (18.0 / 10) = 1.80$$

The mean range ( $\bar{R}$ ) of the test results shall be calculated by taking the ranges of the first five and last five test results. Thus,

$$\bar{R} = \frac{0.8 + 0.7}{2} = 0.75$$

Now the shrinkage has been specified as maximum 2.5 percent.

Hence according to 6.1.2.1 (a), it is found that the value of the expression  $(\bar{x} + k\bar{R})$  comes out to be  $(1.80 + 0.4 \times 0.75) = 2.1$ , which is less than the upper specification limit of 2.5 percent. Hence, the lot consisting of long cloth shall be declared conforming to the specification requirement in respect of warpway shrinkage.

**ANNEX A**

( Clause 2 )

**LIST OF REFERRED INDIAN STANDARDS**

<i>IS No.</i>	<i>Title</i>
4905 : 2015/ ISO 24153 : 2009	Random sampling and randomization procedures (first revision)

**ANNEX B**

( Clauses 3.6, 3.7 and 3.9 )

**GLOSSARY OF SYMBOLS**

$\bar{x}$  Mean; if  $x_1, x_2, \dots, x_n$  are the  $n$  measurements of the item in a sample, then

$$\bar{x} = \frac{x_1 + x_2 + \dots + x_n}{n}$$

$R$  Range: if  $x_1, x_2, \dots, x_n$  are the  $n$  measurements of the items in sample, arranged in the ascending order of magnitude, then  $R = x_n - x_1$

$\bar{R}$  Mean Range; if  $R_1, R_2, \dots, R_m$  are the ranges of  $m$  subgroups of five observations each (so that sample size  $n = 5m$ ), then

$$\bar{R} = \frac{R_1 + R_2 + \dots + R_m}{m}$$

$k$  Coefficient of  $R$  or  $\bar{R}$  for the criteria for conformity

$B$  Maximum value for the expression  $\frac{R}{U-L}$  or  $\frac{\bar{R}}{U-L}$  in criteria for conformity for two-sided specification limits

$U$  Upper specification limit

$L$  Lower specification limit

$\leq$  Less than or equal to

$\geq$  Greater than or equal to

## ANNEX C

( Foreword )

## COMMITTEE COMPOSITION

Chemical Methods of Test Sectional Committee, TXD 05

<i>Organization</i>	<i>Representative(s)</i>
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